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Co-partnership on the Copperbelt

IF there was a theme running through the last annual reports of Sir Ronald Prain to the Rhodesian Selection Trust group of companies, it was that the Group's interests were fully identified with the Federation; indeed he went so far as to say that although the Group would only probably retain copper as its main interest it would certainly remain within the Federal boundary. The recent announcement of an employee share purchase plan may therefore be seen as a further step in the implementation of this policy. It is, however, difficult to comment from London, since clarification of some details of the plan is still awaited.

However, the broad outline is clear enough. There are four basic features to the scheme: the shares are to be bought on the open market; the option to buy is open to all employees—African as well as European—who are earning in excess of a given basic figure (still to be announced); the company will pay 50 per cent of the cost of the shares and the maximum number of shares which may be bought will bear a fixed, but as yet unspecified, relation to the employee's earnings.

The first comment to be made on the scheme is that it is fully in line with enlightened management thinking in the most advanced countries. Thus, not merely is the Federation advancing technologically and economically, but it is also advancing in its ordering of its industrial relations. This is reported to be the first scheme of its kind in Southern Africa and cannot fail to have an influence beyond the immediate confines of the Copperbelt. It will also come as most reassuring news to those who were slightly concerned at the somewhat negative quality of the recommendations put by the Chamber of Mines to the Brannigan Commission last year—recommendations that the Commission rejected rather more than they accepted.

The scheme will also help to foster among all who take part in it the feeling that they have a good stake in the Federation. The numbers of those, chiefly white employees, who come to the Copperbelt in search of high wages which may at some later date be spent on the purchase of a farm, are doubtless far smaller than is commonly supposed; but in any case it will do no harm to strengthen the feeling of belonging. Furthermore, the disadvantages commonly alleged to attach to share purchase schemes hardly seem likely to apply in this instance. For example, it is often urged that for an employee to buy shares in the firm that provides his wages is to put all the eggs in a single basket and that he should not be encouraged to do this. However, in Northern Rhodesia—and for that matter to a large extent in the Federation —everybody's eggs are effectively in the Copperbelt whether they are actually employed in the mines or not. A study of national income will quickly show that.

The decision to pitch the qualifying salary so low as to pull in an appreciable number of "advanced" Africans is obviously a right one. To do otherwise would have been disastrous. It will also help to speed the advancement of Africans in every way and point the way to the development of an African middle class. Yet the peculiarities of the Copperbelt wage structure will produce

an odd effect. To pull Africans into the scheme, the salary "ante" will have to be low; but the lower the "ante" the more the Europeans will be able to benefit. They will do this in two ways: first, they will have a relatively much greater amount of money available for non-essential expenditure and therefore investment; and secondly, they will draw more benefit from the company which is preparing to pay 50 per cent of the share purchase price.

Another, yet obviously crucial aspect of the scheme, on which at present no information is available in London, concerns the conditions of surrender. Will the company, which has contributed half the purchase price, retain any title to the share against the eventuality either of the employee leaving or of his wishing to realize his holding? As regards the latter contingency, it would appear that without some such provision the value of the share to the employee would automatically double at the moment of purchase!

The decision of the company to pay 50 per cent of the share purchase price is an unusual one, but it arises presumably from the decision to buy the shares on the open market. Many of the share purchase schemes recently introduced in the United Kingdom have depended on a special issue of shares to be bought at a par value or at a rate not determined by the market. In some instances also the shares have been of the no-voting type and there have been conditions on the re-sale of the shares. It would certainly have been possible to issue special shares in this way for there was a strong hint that the company would be seeking fresh capital for its development plans in the last annual reports and a small part of this application could have been so allocated in the course of time.

What in effect R.S.T. will be doing by buying in the open market is pulling a little of the capital from Europe and America to the new home of registration. In consequence, there will be many more shareholders available for the official annual meetings of the company. Perhaps it will become necessary to declare annual meeting day as a public holiday! This will be a nice problem to settle but it can wait for the future; for the present it is sufficient to give the scheme a whole-hearted welcome.

UPGRADING SOUTH AFRICA'S URANIUM

The first papers in the symposium on uranium, organized by the various South African scientific societies, are now making their appearance in print and will eventually appear as one volume later this year. They contain a mass of interesting material. For example, an historical survey of the beginnings of the uranium industry is now released, with particular reference to the time before the gold mining industry came into the picture.

One of the things that emerges is that it is extremely doubtful whether the whole major project might have come about had it not been for the expectation that the average grade of the Witwatersrand occurrences would be much higher than they are. In the early stages a series of 200 lb. samples was obtained from a number of mines. These were from selective mining with high gold and uranium values. A little later larger samples, also selective, were sent overseas. As a matter of fact, the Geological Survey had difficulty in obtaining these. The Government Mineral Research Laboratory, of which Professor Taverner is the head, drew the attention of the authorities overseas to this. It may well be that the U.S.A. up to that time may have thought that values were higher than they actually were, or alternatively, that selective mining could be practised. Professor Taverner says that this leaves a doubt as to whether these deposits would initially have attracted the serious and urgent interest they did if the correct value of the ore had been fully realized.

Furthermore, it was found that the rich Blyvoor sample focused attention on the fact that underground determinations by radiometric methods were misleading, due to the contamination of stopes with uranium-rich dust from previous blasting operations. Samples on the surface showed much lower values. Geiger counters at that stage were relatively insensitive and it has since been established that the standard uranium samples used for their calibration were in some cases unreliable. This is clearly shown by the figure for the original Blyvoor sample, which was 0.5 per cent uranium oxide, subsequently proved to contain less than one-third of that amount.

The first attempts to work out a recovery method were along the lines of preparing concentrates, but in spite of most intensive work a successful technique could not be evolved. The snag was that the greater proportion of the uranium content is in the fines of the reef (incidentally, this ties in with the limiting of treatment at Doornfontein and West Driefontein to the minus ½ in. run of mine ore). After the extraction of the gold by cyanidation, the uranium is mostly in the slimes and is unsuitable for concentration methods. The solution was found in the all-leaching process now practised.

The question of devising some method of concentration, however, is not merely one of historical interest. If, as seems most probable, a substantial free market in uranium develops in the year to come, in certain areas it will be desirable to treat more ore than comes under the existing schemes. At that stage, for example, the milling rates of the contributors to the joint plant in the Free State will be very much greater than they are to-day. The question then arises whether it would be an economic proposition to increase the size of the plant or whether a relatively cheap concentration method can be devised to up-grade tonnages. Much the same position exists in the Klerksdorp area. There, in particular, one can speculate on the possibility of the high-grade occurrences if the Afrikander Leases are proving very extensive. At present, the tonnage that can be fed to the Stilfontein plant is 21,000 tons a month. No great increase in this figure can be seen, as any slack in total tonnage allotment in future years will most likely be used by Stilfontein itself as its milling rate increases.

It would seem, therefore, that the development of methods of concentration may prove deserving of a considerable amount of attention over the next few years.

NEW POWER PROJECT FOR CANADA?

A plan that ultimately may make a substantial contribution towards freeing the British Commonwealth for the future from dependence on foreign sources of metals supply, was outlined on Tuesday in a paper presented to The Institution of Civil Engineers by Mr. J. M. Wardle, consulting engineer for a consortium consisting of Ventures, Frobisher and Quebec Metallurgical Industries Ltd. His paper outlines proposals for the reversal of the direction of flow of the upper reaches of Canada's Yukon River. This accomplishment would provide some 5,000,000 h.p. of electricity in one vast hydro-electric scheme. Apart from the obvious technical problems involved, however, one salient difficulty is the fact that the permission of the United States' government would be necessary before any final plans could be made. The Yukon is 1,700 miles in length; of this total, only 570 miles of the river are Canadian.

The production of aluminium, which requires the equivalent of 10 domestic units of electricity for every lb. of output, is the main motivating force behind the conception of a Yukon power supply, although possibilities exist for the development of the region's nickel and lead deposits.

Mr. Wardle said recently that the project is sited in a strategically safe area. He felt that the Commonwealth as a whole would be interested in the conception, and suggested the possibility of Australia sending alumina to Canada for refining. This suggestion has particular significance in view of the recent vast bauxite discoveries in Northern Territory. It would appear, also, that the possibility exists for the establishment of a considerable custom smelting industry along the Yukon, as the shortage of hydro-electric power is already causing American producers to seek a power supply north of the border.

At this stage the overall picture remains somewhat clouded by international legalities. The full impact of the present boundaries, as well as the regulations laid down by past treaty obligations, mean that any Canadian industries established to utilize Yukon power from industrial sites situated on Canadian territory, would have an overland transportation problem from the Canada-Alaska boundary to deep water in the Alaska Panhandle. The plan as envisaged readily adapts itself to stage construction, and indeed this factor is one of the most important of its assets. Power output can be planned to keep pace with anticipated markets, and beginning with 250,000 h.p. can ultimately, through four major stages, reach 4,900,000 h.p.

After considerable investigation a satisfactory industrial area was found on the south bank of the Taku river, just east of the international boundary.

The engineering aspect of the project would require three tunnels totalling 19 miles, the pioneer tunnels being 31 ft. and the subsequent tunnels having a diameter up to 60 ft. Special rock-filled dams that have been found resistant to the earthquakes prevalent in the area will also be necessary.

Yet although the Yukon power project is vast enough in itself, it does not exhaust potential power sites in Canada's far northwest, nor does it place too much power development in the hands of a private company. A review made of potential power sites in Northern British Columbia and the Yukon shows that, in addition to power from this major project, a large amount will be available for mining and industrial development at well distributed points. It is estimated that there will be at least 161,000 h.p. in the Yukon and 463,000 h.p. in North-West British Columbia. The construction of certain diversions and dams associated with the main Yukon project will offer the opportunity of developing an additional 100,000 h.p. or more.

MOA BAY NICKEL PROJECT

Last week we referred to the Moa Bay project in Cuba, which will bring into existence a major new source of the critical metal, nickel. It will also create a new source of another vital metal, namely, cobalt. The U.S. government has contracted to purchase the output of this project during a period ending June 30, 1965 (*The Mining Journal*, 15/3/1957, p. 341).

The nickel resources of Cuba are enormous. A recent study made for the Office of Defense Mobilization stated: "Estimates of the nickel content of Cuban laterite ore reserves approximate 24,000,000 tons, equal to two centuries' consumption by the United States at the current rate of usage".

Freeport Sulphur Company, the sponsor of the Moa Bay project, has been interested in nickel in Cuba since the late 1930's. During World War II it built and operated a nickel plant at the town of Nicaro, Cuba, for the United States government. This plant is now operated for the government by another company, but a Freeport subsidiary continues to supply ore from deposits near Nicaro.

An expansion programme at the U.S. government nickel plant was recently completed at a cost of $37,000,000, $6,000,000 below the original estimate by the Nickel Processing Corporation, a subsidiary of the National Lead Company. This expansion of facilities served to increase the rated capacity of the project by 75 per cent to 25,000 s.tons of nickel annually. The plant, built in World War II and re-activated during the Korean war, set an output record last year by producing 32,123,000 lb. of nickel against 30,275,000 lb. in 1955.

After the outbreak of the Korean war, Freeport engineers and geologists explored the Moa Bay region and established the existence there of large orebodies of nickel and cobalt. The Moa Bay orebodies are located on the north-eastern coast of Cuba about 450 miles east of Havana and 40 miles east of the deposits which supply the government plant. The district is part of a chain of mountains whose predominant rock is serpentine. As the serpentine weathered over the centuries, it decayed and changed into an iron ore known as limonite. The limonite lies near the surface and rests on a bed of still unweathered serpentine.

At Moa Bay, Freeport and its subsidiaries have more than 50,000,000 tons of this limonite ore averaging 1.35 per cent nickel, 0.14 per cent cobalt and 46.5 per cent iron. If nickel-bearing ores containing slightly smaller percentages of nickel are included, the proved tonnage is increased considerably.

To develop a process to treat the ore, Freeport undertook pilot plant work in Texas. This work was followed by a larger programme conducted in co-operation with the government at a pilot plant constructed in Louisiana below New Orleans. The plant, which treated 50 tons of ore a day, took a year to build and was operated for an additional year. The programme, successfully completed last autumn after an outlay of $6,000,000 has demonstrated the feasibility of the new process.

In the operation the ore will be mined from open pits and chemically beneficiated at Moa Bay by sulphuric acid leaching. The resulting concentrates will be shipped to the United States for final separation of the nickel and cobalt. Completion of processing in the United States is necessary because natural gas and other raw materials required are not available in Cuba. An important feature of the process is the recovery of high-purity nickel as a metal rather than an oxide. Another important feature is the obtaining, also in metallic form, of an important by-product, cobalt.

The planned capacity of the Moa Bay mining and refining facilities will be 25,000 s.tons of nickel per year. This represents an increase—in the current U.S. supply—of about 17 per cent. The planned cobalt capacity of 2,200 s.tons per year will be the largest in the Western Hemisphere.

In order to speed the start of production, Freeport and its subsidiaries already have spent $6,000,000 to $7,000,000 in preliminary preparations. Sites have been cleared, roads built, dredging done and a dock constructed. Production operations—to be conducted in the U.S. by Cuban American Nickel Company, a Freeport subsidiary, and in Cuba by Moa Bay Mining Company, a subsidiary of Cuban American—are scheduled to commence by the summer of 1959.

Steel Versus Titanium

THE pre-eminence of steel has survived many challenges. Within a limited range of purposes aluminium and plastics have supplemented steel without interrupting the ever-expanding world demand for ferrous products. Now comes the challenge of titanium, which was the subject of a recent conference convened by Imperial Chemical Industries and attended mainly by representatives of the aircraft industry.

It is not surprising that the interest of aircraft designers has been enlisted in a metal which has only 56 per cent of the density of steel, and which, in alloy form, offers a tensile strength of 70-85 tons per sq. in. and the further advantage of a resistance to corrosion equivalent to that of stainless steel.

At present, the prime cost of titanium is high—though not necessarily prohibitive. For the less complicated forms of the worked metal, the price, it is stated, rarely falls below £5 per lb. and in the case of finished 4 BA bolts a figure of as much as £50 per lb. has been indicated.

But the real problem to be solved by the research engineers is the evolution of titanium-forming techniques on a commercial basis. At the new I.C.I. plant in South Wales, where two powerful four-high single sheet mills have been erected, it is claimed that sheet and strip can be provided to a standard of flatness and gauge consistency equal to that achieved with such other difficult materials as stainless steel.

Cold Working Titanium

There are, however, many other problems which have yet to be solved, not least of which is the evolution of a method for the provision of a grade of titanium suitable for cold working.

Leaders in this new and intriguing field of research in this country are the Imperial Chemical Industries Ltd., but their total production is small compared with that of the United States. As production rises prices may be expected to fall. Indeed, British producers have already announced a price cut of 10 per cent for wrought titanium and titanium alloy products, and it is suggested that if and when the price of the new material becomes competitive, titanium may supersede stainless steel in the favour of fabricators to whom superior corrosion resistance and weight-saving are important considerations.

Meanwhile, the evolution of new types of steel and the advancement of steel making techniques is uninterrupted. Probably in no other industry in this country or abroad has such a comprehensive and well-organized system of research resulted in tremendous advances in the technical practice of the industry.

It has long been the cherished ambition of the industry to eliminate the blast furnace and achieve the production of steel by a single process. A step in that direction appears to have been achieved at the Oberhausen steel works where a new 60-ton "Rotor" steel furnace started full-scale operations early this month.

Herr Graef, the pioneer of this new process, has described the new technique to an assembly of distinguished metallurgists. Liquid pig iron is poured directly into the "Rotor" through an aperture at the front of the 16-yd. long cylinder. Two oxygen streams are injected, one beneath and the other above the metal bath, and tapping is done at the other end of the furnace as with the ordinary open hearth furnace.

The advantage claimed for this new method of steel manufacture is that the capital cost of the plant is no more than £8 10s. per ton of output compared with £12 for basic Bessemer and open hearth furnaces. The daily output of a 100-ton "Rotor"—which is to be completed before the end of this year—is estimated at 1,000 - 1,200 tons of steel and the manpower required for two such furnaces is no more than 23 per shift.

The new process must, of course, be tested by practical results but it is pleasing to observe that the pioneers have courted the fullest publicity. In the steel industry there is open access to the results of scientific discovery.

In similar vein is the decision of the High Authority of the European Coal and Steel Community to sponsor a six-weeks' visit of steel experts to the U.S. for the purpose of an "on the spot" study of American management methods. They will be welcome guests in the United States. The visitors, six in number, will be welcomed by the American Iron and Steel Institute whose Foreign Relations Committee chairman, Mr. William H. Johnstone, has direct charge of the arrangements and there can be little doubt that the visit, which will be devoted to a detailed study of American methods, will be mutually worthwhile.

Speaking at the annual general meeting of the British Iron and Steel Federation in London on Tuesday, Sir Andrew McCance, President of the B.I.S.F., stated that the industry expects that by next year there should be capacity for the production of 24,000,000 ingot tons of steel—twice as much as was being made at the end of the war—and that thereafter demand for steel may continue to rise by at least 1,000,000 tons a year. Sir Andrew gave the following outline of the programme to meet this demand up to 1962, covering all stages in the iron-making, steel-making and finishing processes.

Future U.K. Programme

From the beginning of 1957, the programme includes fourteen new blast furnaces supported by additional coke ovens, ore preparation plants and sintering facilities; and there will be an improvement in the productivity of existing furnaces. As a result, it is expected to have capacity for some 20,000,000 tons of pig iron and ferro-alloys in 1962, or 7,000,000 tons more than in 1956.

For steel, eight new or extended melting shops are planned, together with important improvements at several existing melting shops. In turn, the capacity for finished products will be substantially increased both by the building of new mills and by greater throughput of steel at existing plants. Six modern four-high plate mills should come into production between now and 1962.

The industry will have to spend, on average, about £100,000,000 a year on the development programme. Steel prices must, therefore, be adequate to sustain continuing expenditure on such a scale.

Increasing Uranium Concentrate Production on the Colorado Plateau

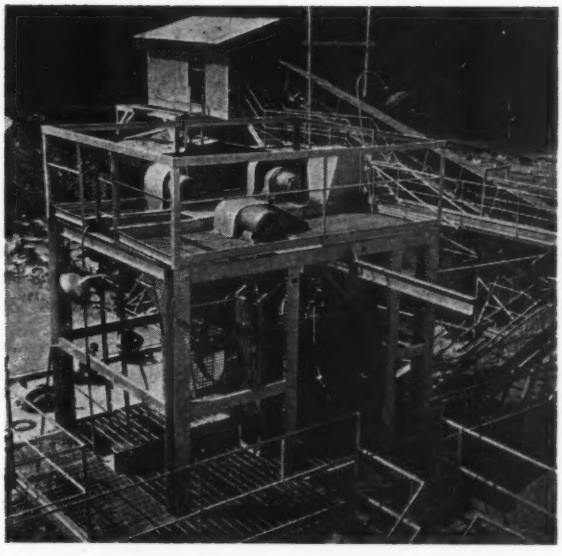
For an industry that began intensified production only three years ago, uranium milling has come a long way in the United States. A recent Atomic Energy Commission announcement that the annual production of uranium concentrates has doubled to a rate of 8,000 tons a year, sounds all the more impressive when it is remembered that only five years ago few, if any people, in the world knew a great deal about uranium milling. The twelve mills on the Colorado Plateau will soon be increased to a total of 20 by virtue of new contracts signed with the AEC. The mills are supplied with carnotite, uranophane, pitchblende, tyuyamunite and other primary and secondary uranium ore minerals by more than 200 mines located on the Plateau in the four States of Colorado, New Mexico, Arizona and Utah.

SINCE the ores being mined on the Colorado Plateau contain an average of 0.23 per cent uranium, the problem of achieving the most complete recovery of uranium possible has been a challenge to the industry. Similarly, with so many different kinds of ores being exploited for their uranium content, one major economic factor in the industry has been the question of discovering technically feasible processes which will uniformly extract the maximum of uranium and produce these values in a readily marketable form for the AEC. The cost of equipment to mill the ores, labour to man the mills, as well as the time consumed in obtaining the uranium oxides, all have a bearing on this question.

Mills operating on the Plateau utilize processes such as salt roast carbonate leach, carbonate leach, acid cure and acid leach to put uranium values into pregnant liquor solutions, all of which are the initial functions of extracting uranium from the ore. Such means as column ion exchange, solvent extraction and resin in pulp, among others, are then used to obtain the uranium.

One key problem that has hounded metallurgists and mill superintendents from the industry's earliest days has been the filtration and separation of pregnant liquors containing uranium from solids and ore tailings. Much work has gone into the testing of various flocculants and filter aids to accomplish this purpose, both in the mills and in the laboratories of chemical companies supplying the industry.

Natural gums and starches as well as inorganic flocculants have been used until recently, but during the last two years of intensive operations on the Plateau synthetic flocculants have come into their own, to provide effective filtration and settling of uranium-rich solutions. To-day, one such synthetic filter aid has, in many instances, supplanted the older products.



Uranium ore being carried by conveyors through intricate sampling equipment on the Colorado Plateau

Separan 2610, the new high-speed flocculating agent of The Dow Chemical Company, was developed several years ago after an extensive period of research. The chemical is a high-molecular-weight acrylamide-type polymer. It has made counter-current decantation, one of the main recovery processes, feasible by greatly decreasing production costs. It has been an indispensable factor in the efficient operation of carbonate leach circuits. Moreover, it has permitted the raw leaching of sandstone ores; roasting had been a necessary preliminary step in treating these ores. Finally, it has changed thinking on the construction of mills by eliminating bottlenecks in mill expansion.

With eight new mills going into production on the Plateau, millers are more and more conscious of the competitive nature of the new industry. Process improvement has been a necessary corollary to this competition and increasing attention is being given to factors such as amortization of plant equipment and the lower AEC price for uranium oxides.

A Colorado mill which thickens and filters fine ore prior to roasting and acid leach estimates that it would have saved $70,000 in plant construction costs if Separan had been available when the mill was originally built. Another big mill in south-west Colorado has found effective use for Separan 2610 in its precipitation plant, where it controls green sludge in large thickeners. The capacity of these thickeners has increased threefold.

Still another big mill in New Mexico has quadrupled the capacity of its filters on current ores by using Separan, while another circuit in the mill has tripled capacity. Another mill in New Mexico has tripled its throughput by using the new flocculant and has obtained better clarification of pregnant liquor going into its ion exchange columns. Separan has also been used to clarify the river water upon which the mill depends for its operation.

In carbonate leach filtration from 0.1 to 0.4 lb. of Separan 2610 per ton of processed material has yielded four-fold filtration rates, while in acid leach filtration from 0.05 to 0.2 lb. of the flocculant per ton is common.

Although the uranium milling industry has made effective use of Separan 2610, other mineral industries, namely copper, lead, zinc, manganese, soda ash, titanium and others, have achieved similar results with the flocculant.

The Granite Controversy, by H. H. Read, is published this week by George Allen and Unwin Ltd., London, at 42s. net.

The Granite Controversy

By R. A. Mackay, D.Sc.

BEFORE I first met the author, a well-intentioned adversary of his said, "You will be meeting a philosopher rather than a geologist". Certainly no praise was intended in this remark, but after I had met him and read his war-time writings I knew that praise had been unintentionally given, though naturally "as well as" should have been substituted for "rather than". Throughout this volume on the "granite controversy", Professor Read is frequently deeply involved with hypotheses and theories, but it is always clear whether he is dealing with fact or theory. (It is unfortunate that this is so often not the case in modern geological writing that it needs to be mentioned.) He goes further than this, in aiding the reader, as objectively as a man can, in evaluating the weight to be attached to the evidence. Where he has recognized that a conclusion (including his own) is a subjective one this is also made clear, often with humour. In taking a middle course he has, he tells us, "been assailed both from the right and from the left"; hard is the path of the liberal. I find it hard, however, to view the author in his self-assumed rôle of a "disputant", except inasmuch as all men of wit must be such.

The "granite controversy" is about 150 years old. At times it cooled, more often simmered, and frequently boiled with violence. Many of the greatest names in geology have been associated with it. Recently we have passed through a period of turbulent boiling, and now appear to have entered a somewhat more tranquil time. It is impossible to assess how much of this improvement is due to Professor Read's writings, but certainly a great deal of it is. Briefly, the controversy is how granites are formed; whether they are formed from molten injected magmas or whether they have arisen from metamorphism of sediments more or less in place, due to ascending radicles. (Even the argument is difficult to formulate shortly and this is somewhat of an over-simplification.)

The orthomagmatists derive their magma from the fractional crystallization of basalt. The granitizationists are more versatile and argue about solid diffusion, solutions, ichors, or juices coming in to promote the transformation. (One wishes, incidentally, that geologists would eschew "juice" which is organic both as to usage and root. "Ichor" may also be organic, but more doubtfully, and it is perhaps redeemed by its respectable mythological ring.) There is latterly the auxiliary argument among the granitizationists, transformers, or what you will, as to whether the change has taken place wet or dry.

The present volume tells us where H. H. Read stands after 35 years of practical and scholarly attention to the matter. There has, indeed, been much change in his angle of view, but essentially he stands where he did: granites can be formed either way. Indeed, it is difficult to see some of the great Precambrian granites and even wildly imagine how they could have been injections; major and minor geometry are both against it. Almost equally difficult is it to imagine how some of the smaller relatively homogeneous granites with sharp walls could have resulted from granitization, certainly in their present forms. But even if it is sometimes simple, it is not usually so, and Professor Read has performed an outstanding service in the proper marshalling and reviewing of the data and the arguments. This has given less learned men than he the courage of their convictions in such matters; it has put some of the extremist protagonists into proper perspective; and has shown us what criteria there are for endeavouring to judge to which class a given granite belongs, for this is only rarely easy.

In arriving at his conclusions the author relies greatly in the development of his ideas on two series: the Plutonic Series, associated with orogeny, and demonstrating the genetic relation between (a) metamorphic rocks, (b) migmatites (i.e. mixtures of (a) and (c)), and (c) granite; and the Granite Series where different granites of closely related origin arise in different positions due to different tectonic control and a different content of heat, and possibly water or mineralizers, giving them different mobility. Different members of the Granite Series will have different positions in time, it being realized that it is "the date of death of a plutonic rock that we are being told". Thus, of three related granites of the same series, one could have been generated totally in its present position, another moved partially or wholly; a third have formed a high level intrusion and be, to use a recent pleasing word, a "permissive" injection over a high level subsiding block.

Concerning the matter of the "wet" and "dry" schools, the author inclines, but not exclusively to the "wet". "There is no unique solution." (Indeed, there is strong evidence for both schools in that the series for velocity of penetration of elements by diffusion are almost diametrically different according to whether this diffusion is in the dry or the wet; and the examples of migrating radicles given in this book are not consistent with only one series.)

It is important to know (particularly in the context of this journal) what the volume holds for the miner. The answer is: Nothing directly. The author claims his "knowledge of economic geology is nil". This could be true, and could even be a good thing, but his knowledge of the geology of mineral deposits is very far from nil as even the two or three small references to it in this volume show. (It would be better if economic geologists and geologists who are students of mineral deposits were more commonly differentiated—for a good geologist can be neither, either or both.)

Indirectly, however, the book is very important to ore geology, for the geologist concerned with mineral deposits must use much endeavour to understand the origins of granites. So only can we break away from many semi-religious theories which derive orebodies directly from

known igneous rocks; consanguinity is not primogeniture. Moreover, there is much in the treatment and discussion of petrology, some of which amounts to criteria of criteria, that can certainly be applied to thinking in ore-geology. For example, a reading of time and crystallization (and deformation) leads one to wonder yet once more, how much of our published paragentic data is far too facile. Again, emphasis on contemporaneity of crystallization and movement over a long time-episode cannot be overstressed in its application to deposition from mineralizing solutions.

Though the author believes he has resolved much, he graciously leaves us plenty of interesting problems, such as the origin of the discontinuous granitic (continental) shell of the earth; the source of granitizing solutions; exactly why granitization and orogeny are inseparable; and whether the central massif of France is upside down or not. For these problems there are only suggested answers, but the author leaves us with complete assurance that his simplification of so much will not leave us with geologically dull decades to come; any lapse in disputation would not be his wish for in his closing words he invites his younger colleagues " to demolish, or not, whatever is said here ".

To conclude : through his evolution as portrayed in the eight addresses which make up the volume, the author has brought himself to the point when he can say, " I believe that no granite problem now exists. Each granite is a unit to be discussed by itself . . . to be interpreted on intrinsic evidence ". So many will now agree with this statement that the author can be regarded as having travelled a most successful road, however long, and hot, it may have been.

NORWAY IN 1956

PRODUCTION of mined products increased in Norway during 1956, and it is estimated that overall output for the year will not differ materially from that of 1955. The increase in production of iron ore was particularly marked, amounting to more than 40 per cent over 1954, the main factor being that the big Sydvaranger mine reached full production to yield 1,100,000 tonnes during the year.

Although official production figures for 1956 are not yet available, the following may be regarded as reasonable estimates. Seven iron ore mines produced 1,514,000 tonnes compared with 1,256,000 tonnes in 1955, while the one ilmenite producer recorded increased output from 158,000 tonnes in the previous year to 190,000 tonnes in 1956. The thirteen pyrites producers raised their tonnage *in toto*, to 863,000 last year, an increase of some 13,000 tonnes. Copper and lead concentrates were up at 28,000 tonnes and 1,350 tonnes respectively, although zinc concentrates at 13,300 tonnes fell from the 14,100 tonnes of 1955. There are in Norway seven producers of copper concentrates, eight of zinc concentrates and two of lead concentrates.

Two molybdenite producers returned an output of 300 tonnes, silver ore fell from 8,200 tonnes to 6,000 tonnes, while output of niobium-tantalum concentrates (40-50 per cent) declined from 306 tonnes in 1955 to 260 tonnes last year, as did the recorded tonnage of graphite, from 5,400 to 5,000 tonnes. Twenty-five mining companies have been operating in Norway since 1954.

One Norwegian iron mine has ilmenite concentrates and two pyrite mines zinc and lead concentrates as their main products. The country's largest pyrite mine, Orkla Grub A.B., smelts most of its pyrite ore for the extraction of elementary sulphur and a rich copper matte. The Sulitjelma Mines treat their copper concentrates in their own smelter to yield about 3,000 tons annually.

Improved Cover for Exporters

IMPROVEMENTS in insurance cover for U.K. exporters have ben announced by the Export Credits Guarantee Department.

From April 1 a completely revised form of cover against payment risks will be available to exporters of goods sold on terms of payment up to two years' credit.

Once shipment has been made ECGD will pay 95 per cent (instead of 90 per cent, as hitherto) of all specified losses outside the control of buyer or seller. Claims arising out of " transfer " or " political " risks (e.g., blockage of exchange by buyer's government) will be settled after four months (hitherto six); claims due to default on goods accepted will be paid after six months (hitherto 12).

For the first time limited cover will be given on default by the buyer *before* acceptance of the goods. Under this heading the exporter must bear a first loss of £20 on every £100 of invoice price : ECGD then bears 85 per cent of any loss within the next £40.

Announcing these improvements Mr. Roland Owen, Comptroller-General of ECGD, said he believed that the changes represented " very substantial assistance " to exporters. Wherever an exporter is working within a financial ceiling, the fuller and earlier reimbursement in the event of a claim under the new guarantee will reduce the extent to which he is " out of his money ", thus enabling him to finance further enterprises.

Other forms of ECGD cover are in course of revision.

Australian Iron Ore Search

THE announcement that the Broken Hill Proprietary Co. is to undertake an extensive search for iron ore in the north of Queensland has been followed by a report that the South Australian government has decided to extend the search for high-grade ore in that State in the hope of locating sufficient tonnage to warrant the establishment of a steel industry in addition to the operations of the Broken Hill Proprietary Co.

The Broken Hill Co. has pegged all areas south of its quarries that indicate any large tonnage of ore. The South Australian government intends to prospect the Middleback Ranges south from these leases. While ferruginous formations outcrop for a considerable distance, indications do not favour their development into occurrences containing any considerable tonnage at moderate depth. It is intended to drill to depths that might involve underground mining to depths to 800 ft. There are very large occurrences of taconite in the vicinity of the high-grade iron occurrences, and the Broken Hill Proprietary Co. is investigating the possibility of their commercial utilization.

A recent announcement by the State government, advises that high-grade iron ore has been discovered near Tarcoola, on the east-west railway line. The locality is northwest from the Middleback Ranges and appears to be outside what has, hitherto, been regarded as the ferruginous zone. It is claimed that the new discoveries are extensive.

The Broken Hill Proprietary Co. has completed the construction at the Port Kembla works of its subsidiary, Australian Iron and Steel, of a modern ore handling, screening and sintering plant at a cost of £A750,000. The plant is one of the largest of its kind in the Western World, and was necessitated by the nature of the ore from Yampi Sound, Western Australia, which is smelted at Port Kembla.

Brake Linings in Mining

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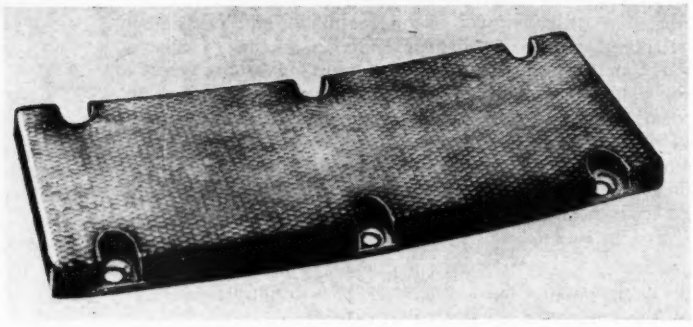


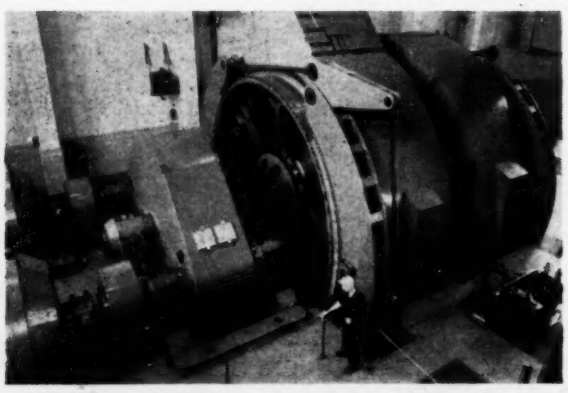
A Ferodo Ferobond lining showing the bonded metal strips

OF the various types of systems used in raising coal to the surface, the old established cage-winding method in which trucks or tubs are used is gradually being replaced by skip-winding, the skip being filled at the pit bottom and emptied on to a conveyor belt at the pit head; this method considerably speeds up loading and unloading.

A continental type of winding gear, occasionally used in this country, but finding wider application overseas, is the Koepe system whereby the normal winding drum is omitted in favour of a large power-driven pulley, the drive to the continuous wire rope being transmitted through wood or friction fabric blocks secured to the pulley rim, or a multiple of lighter cables with a suitably grooved pulley wheel. In both cases, friction braking is accomplished by shoe brakes operating on the pulley rim and it is the usual practice to employ two brake paths as in drum winders.

Ferodo CR lining is presented as being particularly suitable for use on colliery winders. It has a very high friction value and may be operated at working temperatures up to 350 deg. F. It is free from scoring tendencies and may therefore be employed against any of the normal comparatively soft metals used for brake paths. Underground haulage of the coal to the shaft bottom, whether by endless rope, diesel locomotive or other means, requires friction control for which other types of Ferodo lining have been developed.

The changed face of winding practice within the U.K. coal industry has provided Ferodo Ltd., which has been connected with the mining industry for half a century, with new openings for its products. For to-day the manufacturers supply brake linings suitable for the equipment used in many other branches of mining, both at home and overseas, notably deep-level metalliferous mining, open cast operations, and quarrying. These industries, too, have been completely revolutionized since the days when Herbert Frood noticed the brake linings used by carters in the Derbyshire hills.



A modern winding installation showing the massive brakes. The twin electric motors linked by gearing develop 4,000 b.h.p.

Types of Friction Linings

Ferodo friction linings for general engineering purposes can be divided into three principal classes, namely those with :

(a) a woven cotton base,
(b) a woven asbestos base and
(c) an asbestos base formed from random or corded asbestos fibre.

The woven cotton base friction material is invariably non-metallic, but the two asbestos base variants can incorporate a proportion of metal; i.e., non-ferrous wire.

These various types of base materials are impregnated with a variety of chemicals, usually termed the "bond", the choice and blending of the particular chemicals forming this bond imparting to the finished product the particular friction property and resistance to temperature effects desired.

Friction linings with a woven base, whether cotton or asbestos, are manufactured in different degrees of rigidity, the materials having sufficient flexibility to allow forming to the required radius on site. An example of this method is found in the type of friction lining frequently fitted to winding engine brakes. Similar types of friction linings, on the other hand, are given maximum density and must be formed to shoe radius during manufacture.

The last of the necessary requirements of a friction lining, namely that of secure attachment to a particular shoe or band, has lately been alleviated as a problem by the development of Ferodo Ferobond Fixings. This method is applicable to brake linings ¼ in. thick and over.

The purpose of the development is to provide a means of attachment which will enable brake linings to be changed in a very much shorter time than systems at present in use. For operation, the principle consists of lengths of friction linings up to a maximum of 24 in., grooved to take 1, 2 or 3 metal strips which are bonded in position flush with the non-working surface of the lining. The edges of the linings are suitably slotted to enable the countersunk headed bolts to be inserted or removed from

Before the turn of the century Herbert Frood noticed the primitive types of brake linings used by carters in the Peak District of Derbyshire. Translating his observations into concrete action, Mr. Frood began these developments of brake lining manufacture that have culminated in the present international standing of Ferodo Ltd. Although Ferodo brake linings are applicable to all industries from motor car manufacture to the construction of winders, the mining industry claims an impressive percentage of the manufacturer's attention.

the side when the lining is in position on the shoe. Supplied radiused the linings can be readily assembled from the side or alternatively from the top of the shoe or band by merely slacking off the adjusters to the maximum provided.

At present Ferobond is restricted to linings of ¼ in. thick and upwards and can be supplied in any Ferodo woven quality. Ferobond can be incorporated in existing metal shoe layouts merely by the addition of extra holes to take ½ in. or ⅜ in. dia. bolts, in many cases without interference with the existing drilling layout. Alternatively, it is usually a simple matter where wood backing blocks are in use to replace these with a fabricated metal distance piece drilled to take Ferobond or strip lining as an alternative.

Normally brake linings are fixed to their shoes, bands or the like, by means of non-ferrous rivets, bolts and nuts or set-screws, while in the case of large post or caliper brakes these may be secured by suitably disposed wooden pegs, the heads being part countersunk and then cut off flush with the surface of the Ferodo lining. Clutch facings are attached by non-ferrous rivets or set-screws.

The well-known Ferolok method is a patented means of easy and speedy fitting of brake linings and clutch facings, eliminating the usual costly and time-wasting procedure of removing the brake shoes or bands. Supplied grooved and radiused, the friction linings are immediately ready for fitting. The elimination of rivet holes provides an increase in lining area and a safeguard against drum scoring from the collection of foreign matter in the counter-bores. An important feature of Ferolok, as with Ferobond, is that of the progressive advancement of the linings, whereby those linings showing the greatest wear can be removed and each lining moved up round the band or shoe, one new lining only being added at the end showing the least wear.

Fabric Brake Linings

In general, fabric brake linings are more critical at lower temperatures than the mating ferrous surfaces and, therefore, it is the loading on the lining that comprises the determining factor for brake dimensions. Normal conditions are satisfactorily met if the brake lining area is sufficient to limit the average rate of energy dissipation to not more than 16,500 ft./lb. per min. p.s.i. Brakes in this category are represented by those fitted to winding engines, cranes, lifts and the like.

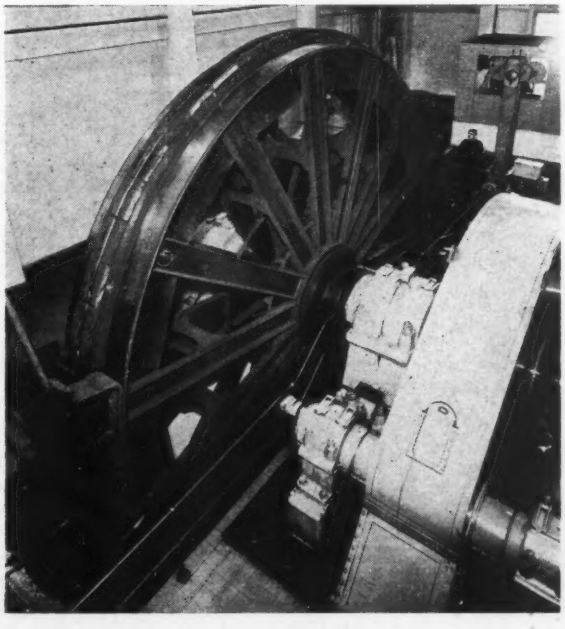
Consequently, lower loading rates must be adopted for severe conditions such as are encountered in brakes for underground haulages, excavating and earth moving plant, rotary drilling rigs and similar applications. For such extremes a corresponding rate as low as 6,000 ft./lb. per min. p.s.i. may not prove too generous in brake lining dimensions. On the other hand, emergency brakes used at infrequent intervals allow the adoption of fairly high loading rates on the brake lining—an average of up to 48,000 ft./lb. per min. p.s.i. being permissible. This type of unit is illustrated by the brakes fitted to flywheel generator sets and acting directly on the flywheel periphery.

Brakes can be broadly classified into two types, namely those with the brake lining attached to one or more rigid moveable parts, shoes or other similar structure; and these brakes designed around the flexible self-energizing band principle.

The rigid shoe brake is the most consistent in performance as it usually carries only a moderate degree of self-energization or servo action. Analysis of the forces in a single shoe must be based on the fact that owing to geometrical constraint, the distribution of brake lining pressure and, therefore, lining wear, follows the radial displacement of the shoe towards the brake drum. Analysis of a two-shoe brake with normal disposition and length of lining and an equal action operating gear, will disclose the mechanical advantage of conforming approximately to simple combined shoe averages, i.e. the positive shoe factor of the leading shoe being cancelled out by the negative characteristic of the trailing one.

The range of Ferodo linings of solid woven non-metallic cotton base chemically bonded are the Fibre and C.R. patterns, with a dry coefficient for design of 0.5 and temperature resistance of 110 deg. C. and 175 deg. C. respectively. These linings are suitable for the brakes fitted to mine winding engines, haulage gears, cranes and lifts. The C.R. pattern may be oil immersed, in which situation it offers a coefficient of friction for design of 0.1.

Of the twelve asbestos based patterns of brake linings produced by the manufacturers, the B.A. and B.A. DP. units have a solid woven asbestos base with the yarn consisting of asbestos fibres spun on fine brass wire. This base is impregnated by a bond having high temperature and wear-resisting properties. Maximum temperature resistance is 260 deg. C. in both cases. Other asbestos base linings are spun around zinc wire, while others have a metallic inclusion in the form of brass chippings. Maximum temperature resistance rises to 540 deg. C.



In a Koepe installation the cable passes around a large diameter sheave, lined with friction material. Two brake paths are used, one on each side of the pulley groove

MINING MISCELLANY

The State Trading Corporation of India is contemplating exporting 1,300,000 tons of iron ore to Japan during the current year.

★

Deposits of uranium have been reported in Aguas do Prata, in the state of Sao Paulo, Brazil. No reliable estimate can yet be made of their value.

★

Eastern Mining and Smelting's copper-nickel plant at Chicoutimi, Quebec, will be bigger than planned, as the company now intends to build a $7,000,000 copper refinery as an integral part of the operation.

★

All of Canadian Javelin's iron-ore deposits in the Wabush Lake and Julian Lake areas, Labrador, will be immediately developed under a new agreement with Pickands Mather and Co. of Cleveland.

★

Arrangements have been made to develop major nickel copper discoveries in the Cape Smith area of Ungava, Quebec. A group of Canadian mining companies headed by Little Long Lac Gold Mines Ltd. has reached an agreement with American Smelting and Refining Co. to explore and develop these prospects. The areas to be explored are covered by applications for concessions and the pact follows two years of discovery and exploration work in the Ungava area. The agreement was completed between representatives of American Smelting and Refining Co., Little Long Lac Gold Mines Ltd., Malartic Gold Fields Ltd., Teck-Hughes Gold Mines Ltd., Sylvanite Gold Mines Ltd., Delnite Mines Ltd., Ore and Chemical Corp. of New York and Lemoyne Explorations Ltd.

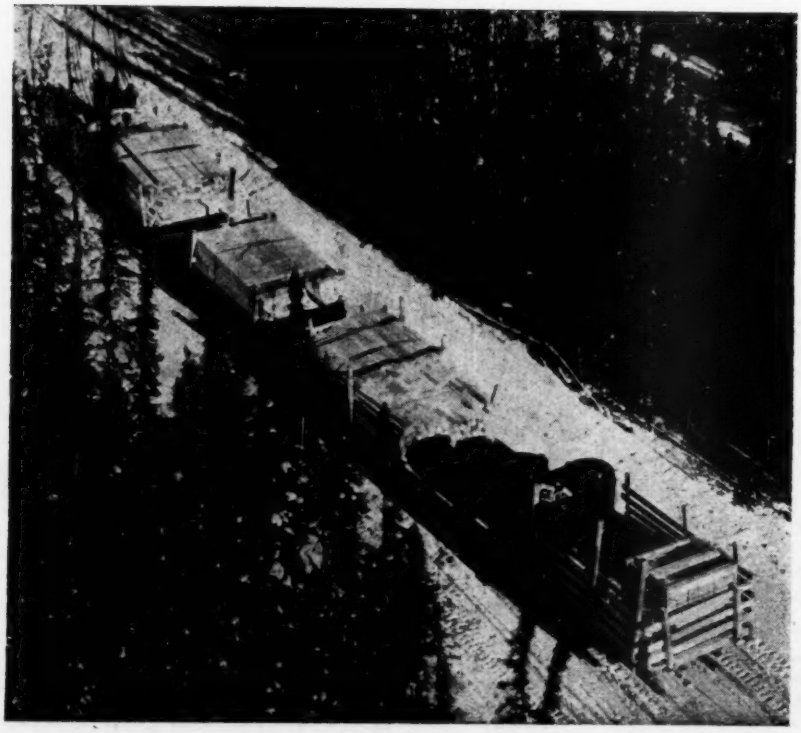
★

The Eire Minister for Industry and Commerce has made an order under the Minerals Development Act of 1940 compulsorily acquiring all minerals under certain lands in the Allihies district of West Cork, and land-owners claiming entitlement to compensation in respect of the minerals in this area are requested to lodge their claims within two months. The order refers to lands already being developed by the Emerald Isle Mining Company—a subsidiary of Can-Erin Mines of Toronto—as well as additional tracts in the same area where mineral deposits are believed to exist. The Emerald Isle Mining Company is at present engaged in dewatering and drilling operations at the old copper mines in Allihies.

★

Eighteen types of mining machinery, mostly for hewing and transporting coal underground, are now exported by Poland to Czechoslovakia, China, Hungary, Albania, Bulgaria, Turkey, Yugoslavia, Korea and Viet Nam. It is expected that the exports of mining machinery will grow by an average of 20 per cent annually and in 1960 will be 80 per cent greater than last year.

A "Snowball Express" tractor freight train on Inco's Mystery-Moak Lakes project



Small helicopters have been used for several years for geophysical exploration work in Papua, where British Petroleum is searching for oil in association with Australian and American interests. Within the next few weeks, however, two new S 58 Sikorskys, much larger machines, will begin an entirely different operation. Namely, the transportation of a drilling rig and equipment to the location of a new well at Komewu. This operation is the first of its type to be carried out in Papua.

★

Magma Copper Co.'s San Manuel mine in Arizona is expected to reach full production at an annual rate of 70,000 tons by July this year. In 1956 the company's copper production reached 63,043 tons, of which 39,076 tons came from San Manuel. The San Manuel mine was producing at about 65 per cent of its scheduled annual capacity at the year end. Mining problems and failure of electrical equipment at one of the two main ore hoists, now corrected, prevented a full production rate.

★

Cartier Mining Co. Ltd., Canadian subsidiary of U.S. Steel, has announced plans for a large-scale iron ore project in Eastern Quebec. Reserves are estimated at 750,000,000 tons of 30 per cent ore, and it is planned to produce 5,000,000 tons of 65 per cent iron ore pellets per year, tentatively from 1961. The scheme envisages open pit mining, the construction of ore concentration plants at the mining sites, a railway approximately 100 miles in length, and the provision of harbour and loading facilities at Shelter Bay. A hydro-electric plant is to be built on the Hart Jaune river.

★

National Potash Co. has placed in operation its mine and refinery near Carlsbad, United States. Initial shipments of potash were made last month from the new facilities which took two years to complete and cost approximately $17,500,000. Designed capacity is 400,000 tons of high-grade muriate of potash annually. National Potash is owned jointly by Freeport Sulphur Co. and Pittsburgh Consolidation Coal Co. In addition ot the refinery, facilities include two 1,800 ft. deep shafts—the deepest in the U.S. potash industry—plus a 21-mile water pipeline and product storage buildings having a capacity in excess of 100,000 tons. Mining operations are highly mechanized.

★

Between the tiny settlement of Thicket Portage on the Canadian National Railways' Hudson Bay line and the site of International Nickel's project in the Mystery-Moak Lakes area some 30 miles away, 24 diesel-powered sled trains are operating 24 hours a day to transport the 30,000 tons of heavy equipment and supplies required to push construction forward in the spring at the two mines and related surface plants. Climaxing weeks of planning and preparation, the job of the tractor trains must be done before the thaw sets in because, pending construction of adequate transportation facilities, this is the only

method of moving in such material. The route of the "Snowball Express" extends 35 miles. Trains on the winter freight run from Thicket Portage to Mystery-Moak, 400 miles north of Winnipeg, are operating on a continuous, non-stop schedule. Each is manned by two crews, one relieving, and 14 hours are required for the 70-mile round trip on the shuttle between the two points. A total of 1,000 trips will be needed to move the materials involved in what is undoubtedly the biggest single freight lift in the history of Northern Manitoba. About 150 men are engaged in the project.

★

On Tuesday, the Hunting Group's three survey and resources development companies at Elstree were visited by H.R.H. the Prince Philip, Duke of Edinburgh. After touring the laboratories of Hunting Aerosurveys Ltd., Prince Philip examined in detail a display of airborne mineral survey equipment used by Hunting Geophysics Ltd. and Hunting Technical Services Ltd.

PERSONAL

The Right Honourable Henry Lennox D'Aubigne Hokpinson Lord Colyton, P.C., C.M.G., Sir Eric Charles Mieville. G.C.I.E., K.C.V.O., C.S.I., C.M.G., and Gerald James Auldjo Jamieson (Director of Robert Fleming & Co., Ltd.) have been appointed directors of the London Tin Corporation Ltd.

★

Sir Edwin Plowden, chairman of the United Kingdom Atomic Energy Authority, has left London for a fortnight's visit as the guest of the South African Government.

★

Mr. L. C. Walker has retired from the Board of Ariston Gold Mines (1929).

★

Euclid (Great Britain) is to extend production at Newhouse, Lancashire, and will treble the size of the factory of its associate, Peterhead Gear Manufacturing, Aberdeenshire.

★

The Jenolite Group has established Jenolite Industries (Northern) Ltd. with headquarters at Huddersfield. The new company is directed by Mr. P. A. Sjogren. The technical manager is Mr. J. S. Armstrong.

★

The Halifax Tool Co. Ltd. have taken over the companies and works of Reliance Trucks Ltd., and Redshaw Lister Ltd. The companies will continue to operate under their own names and make and market the trucks and trailers as previously.

★

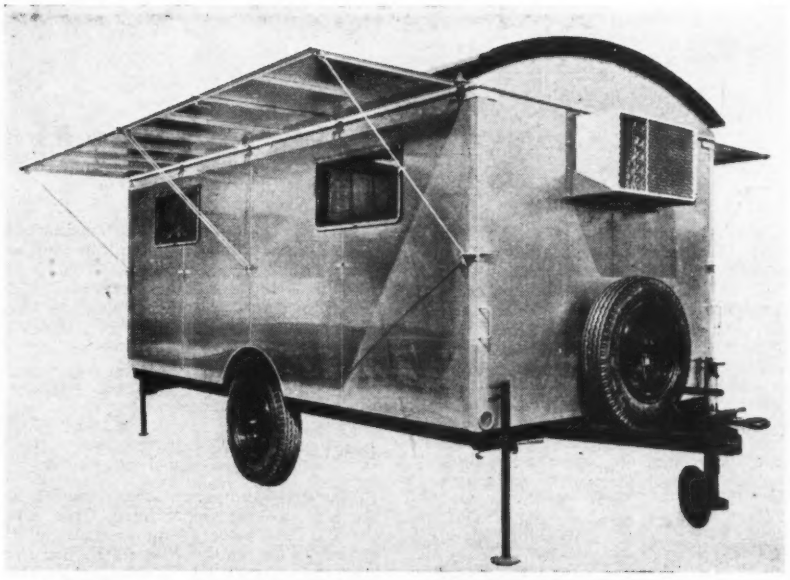
The meeting of The Midland Counties Institution of Engineers, provisionally arranged for April 17, has been cancelled.

★

The public relations office of the Hunting Group is now at Norwich House, 4 Dunraven Street, Park Lane, London, W.1.

★

The Midland office of L. M. van Moppes and Sons (Diamond Tools) Ltd. will be at 47 Warwick Road, Olton, Solihull, Warwickshire, as from March 23, 1957. Telephone Acocks Green 4391/2.



Exterior view of one of the caravans supplied to Shell for service in Pakistan

The General Committee of the Sixth Commonwealth Mining and Metallurgical Congress, to be held in Canada during September and October this year, requests the early return of registration and tour application forms.

CONTRACTS AND TENDERS

The I.C.A. has announced the following future authorizations.

India

156 cwt. aluminium ingots. Bids to Director General of Supplies and Disposals, Shahjahan Road, New Delhi. Closing date March 29, 1957. Ten. 24730. Ref. E.S.B./6554/57. Telephone enquiries Chancery 4411, Extension 738 or 771.

Cuba

The British Embassy at Havana have received a request for catalogues and prices of mining equipment and concentration plants from Equipos Tecnicos Agricolas e Industriales, S.A., of Ayesteran 240, Havana, Cuba. The company is interested in hard rock drilling equipment (both steel and diamond drills) similar to those supplied by The Keystone Co., U.S.A., and compressors for drilling into rock etc. Com. 13141. Ref.: E.S.B./6535/57. Telephone enquiries Chancery 4411, extension 776 or 866.

Greece

M. L. Messinesis & Co., 4 Dragatsaniou Street, Athens, wish to contact United Kingdom firms who wish to participate in calls for tender in Greece and who are not already represented there. Ref.: E.S.B./5337/57. Telephone enquiries, Chancery 4411, Extension 776 or 866.

★

The Australian Shipbuilding Board has ordered two 14,000-ton bulk-carrying ships from the Broken Hill Proprietary Co. shipyard at Whyalla, South Australia. The vessels will be used mainly to carry ironstone for steel-making plant at Newcastle and Port Kembla.

★

Canadian Vickers has received an order for a 20,350-ton ore-carrier from Wilson Shipping, an affiliate of Westriver Ore Transport of Montreal.

Costing £11,000, a fleet of 6 new-type, air-conditioned caravans — especially designed for use in a tropical climate—was shipped recently to Pakistan Shell Oil Company, to provide sleeping and working accommodation for geologists and geophysicists engaged on oil survey and exploration duties. The caravans have obvious applications in mining. Suppliers of this order were the United British Caravan Co., who last year, in conjunction with Shell engineers, designed, for use in Turkey, the first folding camp trailers of their kind to be made in the U.K. Each caravan is 16 ft. long, 7 ft. 6 in. wide, with headroom of 6 ft. 9 in., and fitted with an air-conditioning unit designed to cope with an ambient temperature of 120 deg. F. The cabins have exterior panelling of 18 gauge aluminium and interior panelling of $\frac{1}{4}$ in. tempered masonite.

★

The British Thomson-Houston Co. has obtained an order valued at more than £1,500,000 for two 120,000-kW. C.M.E.R. turbo-alternator sets for the new Padiham "B" Power Station of the Central Electricity Authority (North West Merseyside and North Wales Division).

★

A Tokyo refinery has ordered a year's output from the Macalder-Nyanza copper mine, near the Mohoru Bay of Lake Victoria, Kenya. The order is worth £500,000 to the Kenya mine and will involve the shipment of more than 2,000 tons of copper, the first 350 tons of which will leave Mombasa at the end of this month. The shipment will consist of cement copper containing 70 to 80 per cent of pure copper.

★

The English Electric Company has received an order for electrical equipment for the Aviles Steel Works in the North of Spain. The company has already executed orders amounting in all to about £1,500,000 for mill drives, distribution and rectifying equipment for the Aviles Steel Works, the largest project of its type in Spain. The value of the new locomotive and steel mill electrical equipment orders is approximately £1,800,000.

Machinery and Equipment

New Six-shot Mine Exploder

A new exploder, the M.E.6, Mark I, which has been fully approved by the Ministry of Power as a "P" exploder for firing up to six shots simultaneously in coal mines, is now in production by Marston Excelsior Ltd., a subsidiary of Imperial Chemical Industries Ltd. Smaller and lighter than earlier six-shot exploders, the M.E.6 has been specially designed to meet exacting demands. The strong outer case is of cadmium-plated drawn brass and thus satisfies the recent regulations requiring the absence of aluminium alloys in its external construction.

The M.E.6 Mark 1, six-shot exploder

The exploder is operated by a main 67½ volt battery and condenser, and a circuit testing indicator is incorporated. The electrical circuit and batteries utilize the latest techniques in construction to provide robustness, long life and reliability.

The circuit components are rigidly and permanently embedded in non-conducting material, thus virtually eliminating the possibility of short circuits or broken wires. Suitable shunt and series resistances are incorporated to satisfy completely the requirements of the Ministry of Power regarding the risk of igniting inflammable gas or dust. The circuit indicator, actuated by a separate 1½ volt battery, is of the moving coil type and tells the shotfirer whether the circuit is complete or open or is faulty by reason of excessive resistance. The exploder is 6¾ in. high and 7¾ in. long and weighs only 10½ lb.

POTENTIAL CRUSHER RANGE

The range of crushers manufactured by Hadfields Ltd. has now been extended to embrace new roller-bearing crushers and granulators. The first three roller-bearing crushers to come off the production line are a 36 in. x 24 in. Blake-type crusher with sectional (4 piece) cast steel frame; a 24 in. x 12 in. Blake-type crusher with one-piece cast steel frame; and a 36 in. x 5 in. jaw type granulator (single toggle) with one-piece cast steel frame.

In the design and construction of these machines the manufacturers' earlier policy has been followed, namely, to provide a series of robust crushers. The roller bearings employed are of the double-row, self-aligning type, by Skefko, and are of generous proportions.

These machines are in their final stage of erection and are undergoing tests.

PIPELINE JAMS

The first commercial coal pipeline in the U.S., linking Georgetown, Ohio, and the Eastlake power plant on Lake Erie, got off to an inauspicious start when the line was opened late last month. The powdered coal only travelled some 25 miles of the 108 mile stretch before jamming with an estimated 400 tons of coal in the pipeline. However, it is perhaps inevitable that dislocations occur in the development of a new technique and it is expected that teething troubles will soon be put right.

The pipe-line, built for the Pittsburgh Consolidation Group—the largest coal producer in the U.S. with an annual output in excess of 30,000,000 tons—is expected to be the forerunner of a network of pipes connecting the major producing and consuming centres. The present installation is intended to carry 1,300,000 tons per year from Pitt Consol's Georgetown mine to the Cleveland Electric Co's. power plant on Lake Erie. It is provisionally estimated that coal carried by this pipeline will cost $1 per ton less than coal carried by rail. This $1,000,000 annual saving on the Cleveland Electric Co's. fuel bill is expected to grow, as 85 per cent of the cost of piping coal is fixed, leaving only 15 per cent as wages, costs, etc., liable to appreciable increase. Fixed costs on the railways, however, amount to only 50 per cent leaving a broader area in which costs can rise. Thus should rail charges continue to increase due to rising labour costs the saving to the Cleveland Electric Co. will correspondingly increase.

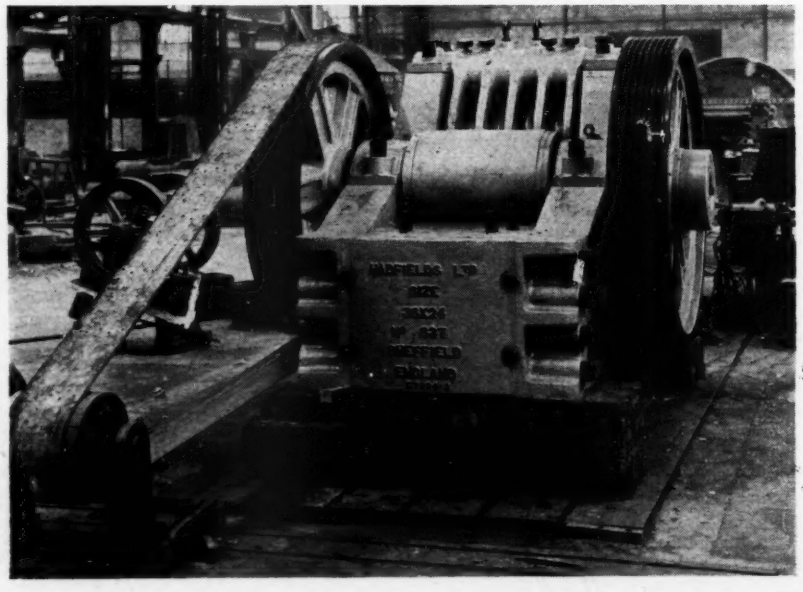
Apart from the usefulness of successful piping to the coal producer and consumer, other industries are keeping a close watch on current developments with the Pitt Consol line. Anything that can be pulverised and is used in a pulverised state can in theory be piped and within a few months another solids-carrying line may begin operation from the gilsonite mines of Salt Lake City to the processing plant 70 miles away. There this solid hydrocarbon will be transformed into petroleum-type fuels.

ONE-PIECE CONVEYOR

The largest conveyor belt ever made in one piece by B. F. Goodrich Industrial Products Co. has been shipped from the manufacturers' belt plant in Akron, Ohio, to Venezuela. Over 1,000 ft. long and 60 in. wide and weighing 22½ tons, the belt will be installed at the ore handling system in Puerto Ordaz, Venezuela,

The belt is made of a combination of superstrength rayon with nylon filler. This combination makes the belt as strong as steel cable and permits belt operating tensions up to 200 lbs. per in. of width per ply. The belt is capable of carrying iron ore at the rate of 6,000 gross tons per hour or 100 tons per min.

The 36 in. x 24 in. roller-bearing jaw crusher



Metals and Minerals

Columbium's Dynamic Long-term Prospects

Production of columbite in Nigeria declined to 2,604 tons in 1955 from the previous year's total of 3,150 tons. All contracts with the U.S. Government at bonus prices were completed by December 31. Producers had to find buyers wherever they could and a substantial tonnage was exported on consignment without a fixed final price. By the end of the year the price for high-grade material had dropped to less than 200s. a unit. The market for columbite is taking a long time to settle down and it is probable that production and prices will remain around present levels during 1957.

There is no doubt that Nigeria is suffering from the 100 per cent bonus given by America during its stockpiling which discouraged all steel manufacturers from using columbite owing to the high cost. It is believed, however, that manufacturers are now again starting to experiment with columbite, but this will not affect the market until at least two years' time. Various investigators who have visited Nigeria have seen for themselves that there are adequate supplies of columbite for many years to come should the manufacturers make up their minds that they will still use columbite.

Looking further ahead, however, encouraging prospects are seen for columbium, particularly in the nuclear and high temperature fields, which might lead to a reasonably large demand. Hitherto this metal has been used almost exclusively as a minor alloying element in stainless steel.

Dr. Frank H. Driggs, president of the Fansteel Metallurgical Corporation, recently described the field of tantalum and columbium as the most dynamic area of this U.S. company's operations. The markets for tantalum are now well established, he stated, and there is no sign of abatement in the increasing demand for this metal. Speaking of columbium, he said that there was reason for at least "cautious optimism" that the metal would have important uses in the field of nuclear power. In the past 18 months substantial quantities of pure columbium metal had been sold for use in experimental nuclear reactors.

Commenting on the new tantalum-columbium plant now under construction at Muskogee, Okla., which is designed to increase Fansteel's production of tantalum by 50 per cent and of columbium by 150 per cent, Dr. Diggs said that "it is by no means certain that the combined capacity of the company's Muskogee and North Chicago plants would be adequate to meet tantalum-columbium requirements after 1958, if any major portion of the potential market for these metals is fully realized".

Columbium owes its potential importance in the nuclear field, to the fact, that it does not suffer extensive radiation damage, due to its low neutron cross section. For example, uranium alloys containing appreciable amounts of columbium are being developed to give greater life as fuels than the uranium base alloys currently being used. Columbium might also be used in reactors as a cladding metal and in certain types of piping for nuclear work. It has high corrosion resistance to liquid sodium and similar metals.

Dr. Morris A. Steinberg, of Horizons Inc., stated at the Conference on Atomic Energy, held at Philadelphia last week, that small-scale production of columbium metal for atomic work was already under way and that within five years columbium might challenge zirconium as a nuclear structual metal. However, important problems still remain to be solved.

Columbium may also provide a means of overcoming high temperature problems. To-day, materials used in the manufacture of jet engines can only withstand temperatures up to 1,800 deg. F. There are indications that research involving the use of columbium in certain alloys may lead to satisfactory results at operating temperatures higher than 1,800 deg. F.

According to Dr. Steinberg, the price of columbium should drop to about $15 to $20 per lb. within the next few years. The current price per lb. in the U.S. for the highest purity grade is $160; for an intermediate grade of purity it is $65.

In 1955 the U.S. imported 4,800 s.tons of columbite valued at nearly $20,000,000. The suppliers were Nigeria, Belgian Congo, West Germany, Norway, Malaya, Australia, Brazil, Portugal, and a number of other countries. In October last year G.S.A. announced that it would probably acquire a maximum of 250,000 lb. of combined pentoxide during 1958, at prices ranging from $1.40 to $3.00 per lb.

Though columbium is apt to be regarded as a rare metal, it was pointed out at the Conference that the actual reserves in North America exceed the combined known total of reserves of molybdenum and nickel. In many of the large North American reserves, columbite is found in complex ores. Thus special ore dressing and concentration methods require to be developed for its economic recovery from these ores and its separation from tantalum. A large number of promising processes have been announced.

Tests are now under way which may lead to the production of columbium metal in Canada for the first time.

REFINED SILVER IN THE U.S.

Production of refined silver in the U.S. in 1956 increased sharply to 78,317,000 fine oz. from 65.881,000 oz. in the preceding year, according to data issued by the American Bureau of Metal Statistics. A breakdown of the 1956 figure shows that 38,157,000 oz. was of domestic origin and 40,160,000 oz. from foreign sources. In 1955 the figures were 33,101,000 and 32,780,000 oz. respectively. Imports of refined bullion jumped sharply to 99,707,000 oz. from 28,861,000 oz. in 1955.

While some Senators have been sponsoring a bill to repeal the U.S. mandatory Silver Purchase Act, similar moves have been rejected by previous Congresses, and the trade does not expect any changes in this respect this year.

STOCKPILING CUTS PROPOSED

A report made to Congress by a House Appropriations Sub-committee estimates that the U.S. total stockpile of strategic materials, mainly metals and minerals, will amount to $8,400,000,000 at the beginning of the fiscal year 1958. The Budget Bureau's recommendation for the purchase of strategic and critical materials in the fiscal year 1958 is $359,627,000, which includes an appropriation of $130,000,000, a carry-over of $145,680,000 from 1957, and lesser funds for other sources in this category.

The report recommends an appropriation of $19,000,000. This tremendous cut in the Budget Bureau's recommendations would amount to about $500,000,000. It is predicted that intensive efforts will be made in Congress to have most of these funds restored.

U.S. ALUMINIUM STOCKS

Due to power losses in the Pacific Northwest and also to the shorter month, U.S. production of primary aluminium fell in February to 119,064 tons—the lowest level in two years except during the strike in August last year. This compares with 132,762 tons in February, 1956. Although at least four of the seven potlines affected should now be resuming operation, the first quarter of 1957 production is likely to be the lowest since the fourth quarter of 1955. Primary producers are endeavouring to have all facilities back in production at the earliest date possible, but attainment of this goal may still be some weeks ahead.

Whatever prospects might have existed for accumulation of plant stocks of new metal to an unmanageable degree have now receded. Inventories at the end of February were at approximately the same level as at the beginning of the month. Moreover, some 40,000 tons of primary metal will be syphoned off into the stockpile during the first six months of the year, leaving the industry's inventories with what is generally regarded as a "comfortable" working margin

QUICKSILVER PRICE FIRMER

The firmer trend of the London quicksilver market continues. Supplies of physical metal on the spot are reported to be on the short side and are believed to be in only a few hands. Some agents have little to offer at the moment,

although some Spanish metal is expected to arrive in the U.K. during April. Spanish and Italian producers appear to be well committed for some time ahead. Japan is still taking metal against earlier purchases.

CHROME ORE OUTLOOK

There is as yet no indication that the world demand for chrome ore has in any way diminished. In fact, more ore would be welcomed to fulfill outstanding commitments. It is understood that there has been some improvement in the movement of ore by the Rhodesian railways, but this is not regarded as indicative of any useful loosening up in the supply position. Some time must necessarily elapse before increased railings can affect the market situation.

★

Turkey is reported to be behind on her contractual obligations, presumably because of transport and seasonal considerations. The U.S. Government's surplus wool for Turkish chrome ore deal may soon be concluded, according to advices from the U.S. which, among other things, disclose that the proposed arrangements involve the trading of some $15,000,000 worth of U.S. Agriculture Department surplus wool for Turkish ore over the four-year period 1958-1962. Price considerations are believed to have prevented the deal from going through last year. A Turkish delegation, including Government representatives, has been in Washington to discuss the deal. Some progress is believed to have been made, though it remains to be seen whether complete agreement can be achieved.

WOLFRAM STEADIER

A steadier tone has developed in the London wolfram market after several months of steadily declining prices. This change is ascribed in part to the desire of producers to hold for higher prices, since for many of them recent levels were considered uneconomic. However, rather more enquiry is reported to be circulating.

The market should be favourably affected by the Board of Trade's announcement that its trading stocks have been virtually disposed of during the last few years, and that limited quantities from its strategic stocks are available for disposal. The total amount at present available for disposal is about 500 tons metal content. The Board's selling agents, British Tungsten Ltd., have instructions to dispose of this quantity gradually, as required, so as to avoid undue disturbance of the market.

COPPER · TIN · LEAD · ZINC

(From Our London Metal Exchange Correspondent)

Last week has been one of those periods where everyone appears to have been waiting for something to happen and business has been at a very low ebb. In the political field the world is now waiting for some concrete evidence from Bermuda that the U.K./U.S. good relationship has been completely restored, and for clarification of the U.S. policy in the Middle East. In the commercial field sentiment in this country has been influenced by the actual outbreak of the shipbuilding workers' strike, the almost certainty that strikes in the engineering industry will commence at the end of this week, and that trouble may develop on the railways. Abroad, industrialists still do not seem to have any confidence in present price levels and are continuing to exist on a hand-to-mouth policy.

CONTANGO IS PROSPECT FOR COPPER

The world price structure in copper has remained unchanged and there has been another small indication that primary producers are determined that the market shall not be allowed to recede much further in the shape of an announced cutback by Phelps Dodge of a reduction in working days from 24 to 23 in a 4-week period. This means that since the autumn this producer has made cuts amounting to about 10 per cent of the total production which in 1956 amounted to approximately 270,000 tons.

Another indication that the lower price is having some effect on production is the announcement that two small producers in the States are getting ready to close down, but on balance this will have no effect as the new properties which are now coming into production under the U.S. government assistance policy have still some way to go before reaching scheduled output. During the week Kennecott reported that during 1956 their production amounted to 582,205 tons with sales at 495,219, but the report added that sales during the first two months of this year have exceeded production.

On the other hand the Copper Institute reports refiners' world stocks at end February as 369,956 s.tons, i.e. 25,000 s.tons higher than a month previously.

In the U.K., stocks in official warehouses were up on Monday by 436 tons at a total of 3,559 tons and this increase has helped towards the elimination of the backwardation on the market and, once more, it is hoped that a reasonably sized contango will soon develop. Readers will remember that it was hoped that this state of affairs would have developed some time ago but on the last occasion when a contango started to appear, the technical position of the market was such that with no additional metal becoming available the backwardation re-established itself: now, however, the technical position is very much more favourable and it is not unreasonable to suppose that during the coming weeks more metal will become available to the market, thereby enabling a contango to become a permanent feature.

Of significance in the long-term is the news that the floods on the Zambesi are now thought unlikely to do serious damage to the work in progress on the Kariba power project, on which the Copperbelt is relying after 1960.

ALL EYES ON THE TIN COUNCIL

The tin market is completely dominated by what people think is likely to happen at the Tin Council meeting taking place at the time of writing and all that can be reported is that there are almost as many opinions as there are people who express them. From an unbiased point of view it would appear that producer countries have some case for raising the floor prices on the grounds of rising costs but there seems very little excuse for raising all the prices throughout the range, although it is reported that U.S. consumers have indicated that they would not create a storm if the ceiling prices were raised a little.

The only real argument in favour of doing anything at all is that at the moment the Buffer Stock Manager is in no position to be able to deal with a situation of temporary shortage resulting in a market price above the upper level permitted, and it is reasonable to assume that some step will be taken to enable him to acquire a reasonable tonnage of metal to give him complete freedom of action. It is expected that some definite decision will be made at the meeting now taking place and that a communiqué will be issued at the week-end.

On the market itself the stocks in official warehouses showed a further rise of 209 tons, making a total of 831 tons, and it now looks as if the flow of metal from the Bolivian ores is commecing, therefore making it reasonable to suppose that the backwardation will narrow to a small figure in the near future. Whether a contango will develop is another matter, for it must be remembered that the tin market is traditionally one in which a backwardation is more likely than a contango.

News from the Butterworth smelter is still vague but it is to be assumed that work has now re-started and that the flow of metal from Malaya will not be interrupted as it appears smelters had sufficient stocks to cover the break in production, the shipment figures for the first half of March being fully up to normal.

Less encouraging is the news from Indonesia, where a State of War and Siege has now been declared throughout the Republic. The extent of the Central government's authority is now very uncertain, and it has yet to be seen what effect the present political crisis has on tin output in Indonesia.

On Thursday morning the Eastern price was equivalent to £782½ per ton c.i.f. Europe.

LEAD AND ZINC

The lead and zinc markets have been featureless, with very little price movement and very few reports of interest either from this country or overseas. In general, it can be said that consumption remains at a satisfactory rate and that there is no unwieldy surplus tonnage of either metal overhanging the market so long as the American government continue to support the U.S. domestic quotations. In the U.K. consumption of both lead and zinc would be affected appreciably if the engineering strike develops, but industry still hopes that commonsense will prevail.

In connection with Cerro de Pasco's new hydro-electric project at Paucartambo, the President has forecast that his corportaion will increase its refined zinc output from the present daily rate of 120 s.tons to 150 s.tons by the end of the year, and eventually to 240 tons per day, equivalent to 87,000 s.tons annually.

Closing prices and turnovers are given in the table overleaf.

LONDON METAL AND ORE PRICES, MARCH 21, 1957

THE WEEK ON THE L.M.E.

	March 14 Buyers	March 14 Sellers	March 21 Buyers	March 21 Sellers
COPPER				
Cash	£238½	£239	£235½	£236
Three months	£238	£238½	£236	£236½
Settlement	£239		£236	
Week's turnover	9,475 tons		6,050 tons	
LEAD				
Current ½ month	£113	£113½	£113	£113½
Three months	£112½	£112½	£112	£112½
Week's turnover	4,425 tons		1,250 tons	
TIN				
Cash	£763	£765	£771	£772
Three months	£747	£748	£761	£762
Settlement	£765		£772	
Week's turnover	1,380 tons		975 tons	
ZINC				
Current ½ month	£95½	£95¾	£95½	£95¾
Three months	£94½	£94¾	£94	£94¼
Week's turnover	5,400 tons		2,025 tons	

METAL PRICES

Aluminium, 99.5%, £197 per ton

Antimony —
English (99%) delivered, 10 cwt. and over £210 per ton
Crude (70%) £200 per ton
Ore (60%) bases 23s. 6d./24s. 6d. nom. per unit, c.i.f.

Arsenic, £400 per ton

Bismuth (min. 1 ton lots) 16s. lb. nom.

Cadmium 12s. 0d. lb.

Cerium (99% nett), £13 18s. lb. delivered U.K.

Chromium, 7s. 2d. lb.

Cobalt, 16s.-19s. lb.

ORES AND OXIDES

Bismuth .. .. 65% 8s. 6d. lb. c.i.f.
20% 3s. 3d. lb. c.i.f.

Chrome Ore—
Rhodesian Metallurgical (semifriable) 48% .. .. £17 8s. 0d. per ton c.i.f.
,, Hard Lumpy (45%) .. .. £17 8s. 0d. per ton c.i.f.
,, Refractory 40% .. .. £12 15s. 0d. per ton c.i.f.
,, Smalls 42% .. .. £16 5s. 0d. per ton c.i.f.
Baluchistan .. .. £18 15s. 0d. per ton c.i.f.
Columbite, 65% combined oxides, high grade .. .. 185s./197s. 6d. per unit
Fluorspar—
Acid Grade, Flotated Material .. .. £22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF_2) .. .. 156s. 0d. ex. works

Lithium Ore—
Petalite min. 3½% Li_2O .. .. £8-£10 per ton f.o.b. Beira
Lepidolite min. 3½% Li_2O .. .. £8-£10 per ton f.o.b. Beira
Amblygonite basis 7% Li_2O .. .. £28-£32 per ton f.o.b. Beira
Magnesite, ground calcined .. .. £28 0s./£30 0s. d/d
Magnesite Raw (ground) .. .. £21 0s./£22 0s. d/d
Molybdenite (85% basis) .. .. 8s. 5d. nom. per lb. (f.o.b.)

Titanium Ore —
Rutile 95/97% TiO_2 .. .. £64/£65 per ton c.i.f. Aust'n
Ilmenite 52/54% TiO_2 .. .. £11 per ton c.i.f. Malayan
Wolfram and Scheelite (65%) .. .. 150s./160s. 0d. per unit c.i.f.

Manganese Ore Indian
Europe (46%-48%) basis 165s. freight plus 17½% surcharge .. .. .. 145d. nom. per unit c.i.f.
Manganese Ore (43%-45%) .. .. 116d. nom. per unit. c.i.f.
Manganese Ore (38%-40%) .. .. 111d. nom. per unit. (including duty)

Vanadium —
Fused oxide 90-95% V_2O_5 .. .. £12½-£13½ per unit c.i.f.
Zircon Sand (Australian) (65-66% ZrO_2) .. .. £20 per ton c.i.f.

Germanium, 99.99%, Ge. kilo lots 3s. 4d. per gram

Gold, 250s. 3½d.

Iridium, £27/29 oz. nom.

Lanthanum (98/99%) 15s. per gram

Manganese Metal (96%-98%) £310

Magnesium, 2s. 5½d. lb.

Nickel, 99.5% (home trade) £600 per ton

Osmium, £20/22 oz. nom.

Osmiridium, nom.

Palladium, £8 0s./£8 10s. oz.

Platinum U.K. and Empire Refined £33/£34 oz.
Imported £33½/£33½ nom.

Quicksilver, £85/£86 ex-warehouse

Rhodium, £42 oz.

Ruthenium, £15/£17 oz. nom.

Selenium, 85s. nom. per lb.

Silver, 79½d. f. oz. spot and 79½ f'd.

Tellurium, 15s./16s. lb.

LONDON STOCK EXCHANGE PRICES, MARCH 20, 1957

Finance	Price Mar. 20	+ or — on week
African & European	58/1½	—7½d
Anglo American Corpn.	7⅞	+⅛
Anglo-French	21/-	.....
Anglo-Transvaal Cons.	26/3	.....
Central Mining (£1 shrs)	60/7½	—1/10½
Consolidated G'fields	56/6	—6d
Consol. Mines Selection	28/3	—9d
East Rand Consols	1/6	+1½d
General Mining	66/3	—1/3
H. E. Prop.	8/-	.....
Johnnies	40/6	—4½d
Rand Mines	65/-	.....
Rand Selection	34/4½	—7½d
Union Corporation	37/6	+3d
Vereeniging Estates	5⅛	.....
Writs	35/6	—1½d
West Wits.	33/3	—3d
Rand Gold		
Blyvoors	19/-	—3d
Brakpan	5/6	.....
Buffelsfontein	32/10½	.....
City Deep	12/9	—3d
Consol. Main Reef	12/10½	+9d
Crown	27/6	—7½d
Daggas	32/-	—6d
Dominion Reefs	17/6	—6d
Doornfontein	21/9	—6d
Durban Deep	22/3	+3d
E. Champs	3/1½	+1½d
E. Daggas	7/9	+3d
E. Geduld (4s. units)	27/-	.....
E. Rand Props.	42/6	.....
Geduld	70/-	.....
Govt. Areas	2/10½	—1½d
Grootvlei	16/7½	+3d
Hartebeestfontein	47/4½	+6d
Libanon	6/7½	—1½d
Luipaards Vlei	13/7½	—1½d
Marievale	16/7½	.....
New Kleinfontein	3/6	+1½d
New Pioneer	19/-	.....
Randfontein	32/-	.....
Robinson Deep	6/10½	+1½d
Rose Deep	8/-	.....
Simmer & Jack	3/9	.....
S.A. Lands	21/-	—3d
Springs	2/3	+1½d
Stilfontein	26/3	—6d
Sub Nigel	17/9	—3d
Vaal Reefs	31/1½	—3d
Van Dyk	2/3	.....
Venterspost	12/-	.....
Vlakfontein	14/1½	—1½d
Vogelstruisbult	12/9	.....
West Driefontein	4⅛	—⅛

Rand Gold contd.	Price Mar. 20	+ or — on week
W. Rand Consolidated	31/3	—7½d
Western Reefs	28/-	—1/-
O.F.S. Gold		
Freddies	5/6	—6d
Freddies Consolidated	3/3	+3d
F.S. Geduld	68/9	—7½d
Geoffries	3/-	.....
Harmony	21/9	—1/-
Loraine	4/1½	—1½d
Lydenburg Estates	12/3	.....
Merriespruit	4/4½	—3d
Middle Wits	8/1½	—6d
Ofsits	51/3	—9d
President Brand	51/3	.....
President Steyn	28/6	—9d
St. Helena	25/7½	—4½d
Virginia Ord.	9/3	.....
Welkom	13/6	—6d
Western Holdings	67/6	—7½d
West African Gold		
Amalgamated Banket	1/3	.....
Ariston	4/1½	+3d
Ashanti	16/-	—3d
Bibiani	2/1½	.....
Bremang	1/4½	.....
Ghana M.R.	1/7½	+1½d
Konongo	1/5½	—½d
Marlu	3d	.....
Taquah	1/1½	.....
Western Selection	5/7½	—4½d
Australian Gold		
Gold Mines of Kalgoorlie	13/10½	.....
Great Boulder Prop.	12/6	.....
Lake View & Star	18/10½	.....
Mount Morgan	13/3	.....
North Kalgurli	7/6	.....
Sons of Gwalia	1/9	.....
Western Mining	10/-	—4½d
Miscellaneous Gold		
Cam & Motor	7/7½	.....
Champion Reef	14/3	+3d
Falcon Mines	7/9	.....
Globe & Phoenix	23/-	.....
Motapa	1/-	.....
Mysore	3/7½	—1½d
Nundydroog	19/9	+9d
St. John d'el Rey	53/9	—1/6
Zams	50/-	.....

Diamonds and Platinum	Price Mar. 20	+ or — on week
Anglo American Inv.	8½	—¼
Casts.	24/10½	—6d
Cons. Diam. of S.W.A.	10/10½	—1½d
De Beers Defd. Regd.	4½	—¼
De Beers Pfd. Regd.	14½	—¼
Pots. Platinum	14/9	—1½d
Waterval	24/6	+3d
Copper		
Bancroft	41/3	—7½d
Chartered	67/9	—1/3
Esperanza	2/9	+1½d
Magundi	9/6	—6d
Messina	8⅛	.....
Nchanga	12⅛	+⅛
Rhod. Anglo-American	4½	—⅛
Rhod. Katanga	38/-	—3/-
Rhodesian Selection	22/6	+6d
Rhokana	37½	.....
Rio Tinto	4½	.....
Roan Antelope	11/10½	—4½d
Selection Trust	4½	—⅛
Tanks	7⅛	—⅛
Tharsis Sulphur Br.	4⅛	—⅛
Tin (Eastern)		
Ayer Hitam	25/3	.....
Gopeng	14/7½	—3d
Hongkong	6/10½	—3d
Ipoh	17/6	.....
Kamunting	9/9	.....
Kepong Dredging	5/3	.....
Kinta Tin Mines	21/6	+3d
Malayan Dredging	14/4½	.....
Pahang	14/4½	.....
Pengkalen	17/-	.....
Petaling	6/1½	+3d
Rambutan	18/3	+6d
Siamese Tin	12/3	+9d
Southern Kinta	16/10½	+6d
S. Malayan	9/7½	.....
S. Tronoh	6/10½	.....
Sungei Kinta	20/3	+6d
Tekka Taiping	8/6	.....
Tronoh	12/9	.....
Tin (Nigerian and Miscellaneous)		
Amalgamated Tin	9/-	.....
Beralt Tin	42/-	+1/-
Bisichi	4/1½	+1½d
British Tin Inv.	23/-	+6d
Ex-Lands Nigeria	2/3	.....
Geevor Tin	20/7½	.....

Tin (Nigerian and Miscellaneous) contd.	Price Mar. 20	+ or — on week
Gold & Base Metal	1/2½	+½d
Jantar Nigeria	3/3	—3d
Jos Tin Area	15/-	.....
Kaduna Prospectors	2/-	.....
Kaduna Syndicate	2/1½	.....
London Tin	10/3	—3d
United Tin	10½d	+1½d
Silver, Lead, Zinc		
Broken Hill South	72/6	+6d
Burma Mines	4/-	—1½d
Consol. Zinc	81/-	+6d
Lake George	9/9	—1½d
Mount Isa	29/3	+2/-
New Broken Hill	51/9	+6d
North Broken Hill	6½	+⅛
Rhodesian Broken Hill	13/-	—1½d
San Francisco Mines	24/1½	+3d
Uruwira	4/-	.....
Miscellaneous Base Metals and Coal		
Amal. Collieries of S.A.	2½	+⅛
Associated Manganese	35/3	—9d
Cape Asbestos	10/-	—4½d
C.P. Manganese	24/6	+6d
Consol. Murchison	50/-	+3/9
Natal Navigation	3½	+⅛
Turner & Newall	110/1½	—3/1½
Wankie	18/1½	—1½d
Witbank Colliery	5½	.....
Canadian Mines		
Dome	$25½	+½
Hollinger	$49	—¼
Hudson Bay Mining	$159	+1
International Nickel	$202½	+5
Mining Corpn. of Canada	£6½	.....
Noranda	$104	.....
Quemont	£6½	.....
Yukon	4/6	.....
Oil		
Apex	39/6	—1/3
Attock	36/9	—9d
British Petroleum	142/3	—10½d
Burmah	89/6	—1/1½
Canadian Eagle	61/9	—9d
Mexican Eagle	22/1½	.....
Shell	174/3	+5/-
T.P.D.	52/3	+1/3
Ultramar	66/-	—1/-

Mining Finance

Gold Fields' Bid For S.W.A. Co. Successful

The recent bid of £5 cash per share for the S.W.A. Co. by Consolidated Gold Fields of South Africa representing a consortium including the Anglo American Corporation of South Africa and the British South Africa Co., has been accepted by over 66⅔ per cent of holders.

The S.W.A. Co.'s lead-zinc-vanadium-tungsten mines, and its holding of 95,000 shares in Tsumeb Corporation, are thus to be retained in British hands—a welcome change from the story of recent American take-overs and infiltrations into the Commonwealth's mineral industries. In addition to these valuable assets are the company's private holdings on its Concession Area in Damaraland which covers in all some 3,000 sq. miles. The remainder of this enormous area is being examined by Tsumeb Exploration in which the S.W.A. Co. holds a 25 per cent interest and thus stands to benefit to this extent in any discoveries made. This arrangement applies to all minerals except lead-vanadates which, if found, revert entirely to the S.W.A. Co.

It will be recalled that a previous bid had been made by the Tsumeb Corporation which offered one Tsumeb share plus £1 in cash for every four S.W.A. Co. shares. The Tsumeb Corporation is predominantly owned by large American interests including the Newmont Mining Corporation and American Metal Co.

Although the price paid by Gold Fields and its associates is an extremely favourable one to S.W.A. Co.'s holders —who have watched their shares rise from only £2 10s. in 1956—there can be little doubt that the company has been acquired most reasonably. The new controllers intend to undertake a vigorous campaign of exploration and development on S.W.A. Co.'s properties, but even if this yields no favourable results, the Tsumeb holding alone would very probably justify the purchase price.

If Tsumeb's offer had been accepted, its shares would subsequently have received a Stock Exchange quotation which should have brought about the publication of yearly technical and financial information regarding the company's operations. It would have been most interesting to find out something about the value and extent of mineral deposits at Tsumeb about which almost nothing is known, but which have always been reputed to be extraordinarily rich. Meanwhile, it must remain a mystery just what Tsumeb shares might have commanded on the open market. Estimates on this have varied widely from as low as £15 per share to as high as £25 according to choice of yield basis, and view of future growth—based on the limited information available.

S.A. BUDGET: NO SUBSIDY FOR GOLD

From a mining point of view the maiden budget of Mr. T. Naude—South African Minister of Finance—introduced last Wednesday, was distinctly unfavourable. Firstly, the much canvassed subsidy for marginal gold mines (these properties do not pay sufficient tax for concessions of this nature to be of any assistance) did not materialize, and secondly a further 6d. in the £ was imposed on companies including diamond, base metal and all other mines other than gold producers.

Other important features of the budget were a relaxation in import restrictions, and a saving levy of 10 per cent on individuals designed to help finance capital works. Mr. Naude has budgeted for estimated total revenue of £286,500,000 and estimated total expenditure on revenue account of £273,000,000 which, after a contribution to the loan account from current revenue of £13,500,000, would leave neither surplus nor deficit. The Minister expressed his belief that no danger of a recession in the near future existed in the South African economy, although development was proceeding at a slower pace than in previous years. It was difficult to forecast whether capital inflows into the Union would improve during 1957, but current financial experience indicated a revival.

Market conditions both on Wall Street and the London Stock Exchange were quiet during the past week. In the U.K. strikes in the shipbuilding industry, which are due to spread to the engineering industry, created great uncertainty. The dangerous situation between the railways and the N.U.R. was also a most depressing influence.

Index	*Mar. 14*	*Mar. 20*
Dow Jones Ind. ...	473.93	473.93
F.T. Ord. ...	185.6	182.2
F.T. Gold ...	72.0	71.5

At first, Kaffirs were noticeably firmer on hopes of concessions in the S.A. budget, but when Mr. Naude's speech became available the market weakened all round and earlier gains disappeared. Diamonds went lower following the imposition of higher taxation.

Platinums and coppers showed no particular change on the week and tins held firm.

Financial News and Results

Union Corp. Pays More.—Preliminary year-end figures released this week by Union Corporation reveal a greatly increased net profit at £1,973,473 against £1,119,689 in 1955 while tax remains virtually unchanged at £486,100. It is proposed to make a final dividend payment of 2s. on the 2s. 6d. shares, raising the total distribution for the year by 10 per cent to 120 per cent. At yesterday's price of 37s. 6d. per share this distribution gives a yield of slightly over 8 per cent.

Harmony Pays 6d.—Dividend No. 2 of 6d. per share has been declared by Harmony Gold Mining Company payable to shareholders registered at the close of business on March 30, 1957. Warrants will be posted on about May 21, and the company's Transfer Books and Register of Members will be closed from April 1 to April 7, both days inclusive.

Extraction at Ariston.—In his statement to shareholders of Ariston Gold Mines, Major-General W. W. Richards, the chairman, announced that as a result of research carried out by metallurgists a new process has been evolved which was producing better extraction rates without involving any capital expenditure on plant, any increase in overheads, or an undue rise in milling cost per ton. In other words, every 1 per cent improvement in the rate of extraction represented almost wholly profit.

During February 39,690 tons of ore were milled at the mine which yielded the record amount of 12,296 oz. of gold. Working profits were £49,471. In January working profits were only £36,902.

(*Continued on page* 382)

RECENT FINAL DIVIDENDS AND PRELIMINARY FIGURES

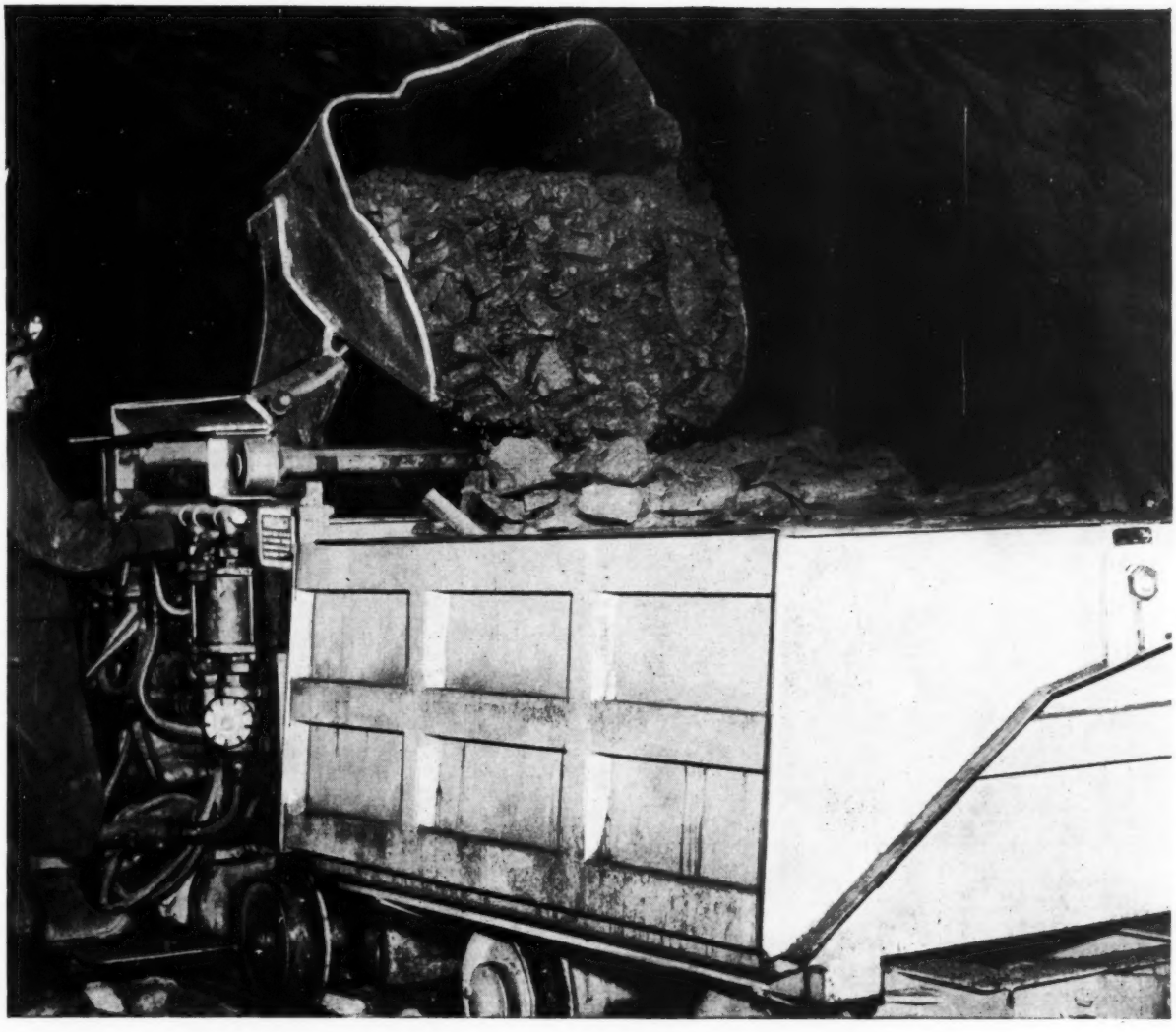
Company	*Year Ended*	*Final Dividend*	*Net Profit After Tax*		*Total Dividend*	
			This	*Last*	*This*	*Last*
			£(000)	£(000)	%	%
British Guiana Gold	31.12.56	Nil	—	—	Nil	5
Burma Mines (*a*)	31.12.56	8¼	241	198	8¼	5½
Broken Hill Prop.	31. 5.56	5	—	—	10	10
Minerals Separation	31.12.56	20	323	225	30	25

(*a*) Profits *before* tax.

RECENT INTERIM DIVIDEND ANNOUNCEMENTS

Company	*Year Ending*	*Dividends Latest*	*Dividends Corresponding*	*Date Payable*	*Total last Year*
		%	%		%
Ayer Hitam Tin	30. 6.57	5	10	April 16	40
Kinta Tin (*a*)	31.12.57	50	10	April 16	70
Sungei Besi	31. 3.57	15	10	April 23	40
Tanjong Tin	31.12.57	25	30	April 18	140

(*a*) Latest payment on £48,000 capital (£120,00).



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L-19

Good Liquidity of Borax (Holdings).—The consolidated balance sheet of Borax (Holdings) at September 30, 1956, revealed net liquid assets of over £8,000,000. Fixed assets totalled £24,291,459 (£6,444,438). During the past financial year Borax (Holdings) made group trading profits of £3,190,115 (£2,455,652) and paid dividends which absorbed £477,250 (£442,750). The balance carried forward rose to £2,533,259 from £1,313,914. Mr. D. Abel Smith is chairman. Meeting, London, March 27.

Scottish Australian Distribution.—The Scottish Australian Mining Company (in voluntary liquidation) proposes to make a first distribution of 5s. 3d. per 4s. unit of stock payable on and after April 3 to stockholders appearing on the register at the close of business on March 1.

Aluminium's Higher Income.—During 1956 Aluminium Ltd. made group net income of $55,600,000 compared with $48,193,952 previously. This represented $5.56 per share against $4.83 for 1955.

O'Okiep To Curtail Production.—The O'Okiep Copper Company plans to curtail copper production to 28,000 s.tons during 1957. This compares with nearly 33,000 tons produced in 1956, and a rated plant capacity of nearly 36,000 tons.

Faraday Uranium. — Production at Faraday Uranium Mines—situated at Bancroft about 140 miles north-east of Toronto, Ontario, is expected to start next month.

Bisichi Offer Extended.—The date for acceptance of an offer made by The Bisichi Tin Co. (Nigeria) to acquire the shares of Naraguta Tin Mines has been extended from March 11 to March 25.

Investment Policy of General Tin.—In his statement to shareholders of General Tin Investments, Mr. S. H. Smith, the chairman, has referred to a number of minor alterations made in the company's portfolio during 1956.

The company, he said, had continued to invest—in a comparatively small way—in U.S. and Canadian companies including oil, banking and utilities. It was in the company's long-term interest to spread its investments geographically as well as industrially, and there appeared no better field for that purpose than the North American Continent. Quoted investments held by the company at December 31, 1956, had a book value of £2,548,516 and a market worth of £3,648,533. Net profit after taxation for the year ended December 31, 1956, rose to £223,037 from £179,449.

Investment Values of Anglo-French.—At December 31, 1956, quoted investments of The Anglo-French Exploration Company were shown at a book value of £1,101,642 and had a market worth of £1,495,296. Profit and dividend figures were reported in our issue of February 22 (page 248). Meeting, London, April 3.

Falcon to Increase Capacity.—In his statement to shareholders of Falcon Mines, Mr. E. B. Papenfus, the chairman, said that in view of satisfactory development results obtained in the lower levels of the mine, it had been decided to increase the reduction plant's capacity from about 15,000 tons to 20,000 tons monthly. It was also hoped to effect some improvement in gold extraction. If deliveries in plant did not cause unforeseen delays, mill extensions should be completed soon after June, 1957.

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